

Clouds or Snow?

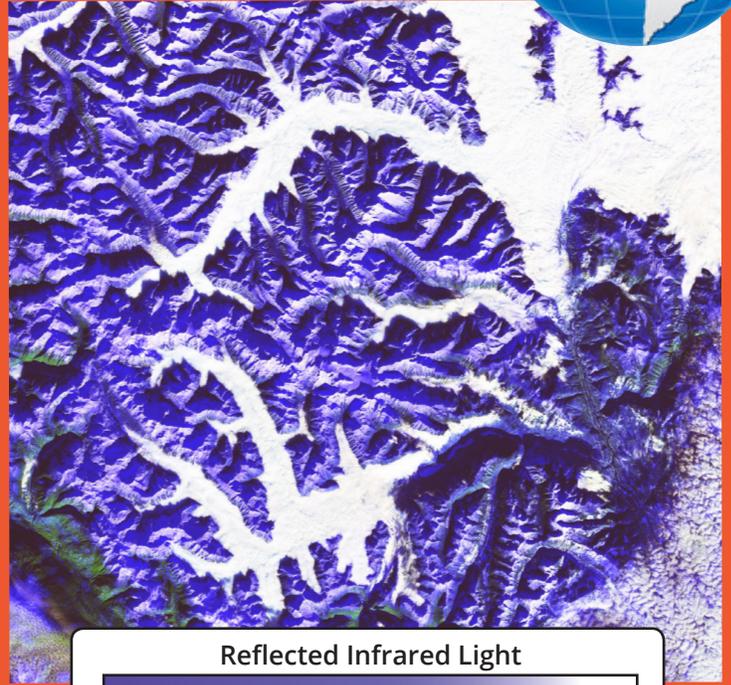
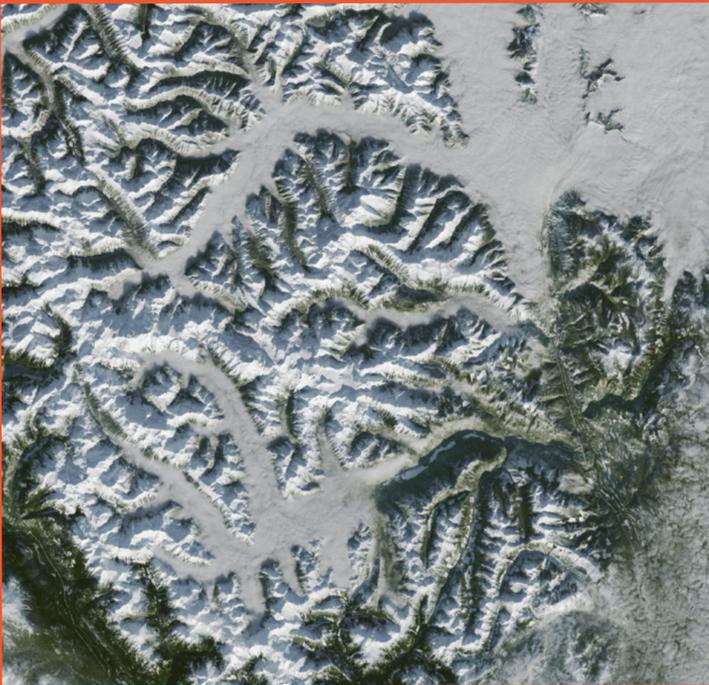
A Satellite Mystery

Clouds and snow can look the same from a distance. You might not easily spot the difference, but satellites can tell clouds from snow by measuring light that humans cannot see.

Vancouver,
Canada



Both of these images show the same scene of clouds and snow from space. But, what is purple in the image on the right?



Reflected Infrared Light

less

more

Snow and clouds have a lot in common. They are both white, they are both made of water, and they both reflect a lot of sunlight. From above, snow and clouds look very similar.

But snow and clouds have key differences. Snow covers the land for entire seasons in some places. Clouds float through the sky, change shape, and travel around the Earth in days or weeks. Clouds and snow also differ in temperature, texture, and the **density** of **molecules**. Snow is denser than clouds. To quickly spot the difference, some satellites measure both visible light and infrared light.

Some satellites measure infrared light, which is absorbed or reflected by different material on Earth. To show these measurements in an image, scientists and visualizers use a color scale to show the amount of infrared light reflected and absorbed. In this image of the Coastal Mountains near Vancouver, valley fog (low clouds) appears white because it reflects more infrared light and snow appears purple because it absorbs more infrared light.

Vocabulary:



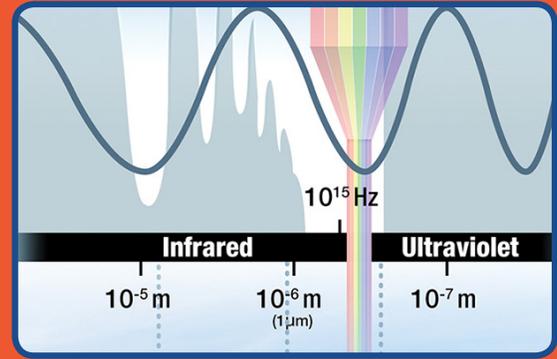
density — The amount of matter in a unit of area or volume.

molecule — A group of two or more atoms that are linked to each other and act as a unit.

Seeing in Infrared

You cannot see infrared with the naked eye, but you can feel it as heat. Satellites that measure infrared also can sense this heat. Snow and water vapor (which make up clouds) are not the same temperature. Satellites with infrared sensors can measure the temperature difference between them. This gives scientists the ability to use satellites to quickly determine what is a cloud and what is snow without having to stick a thermometer in a cloud or a snow bank.

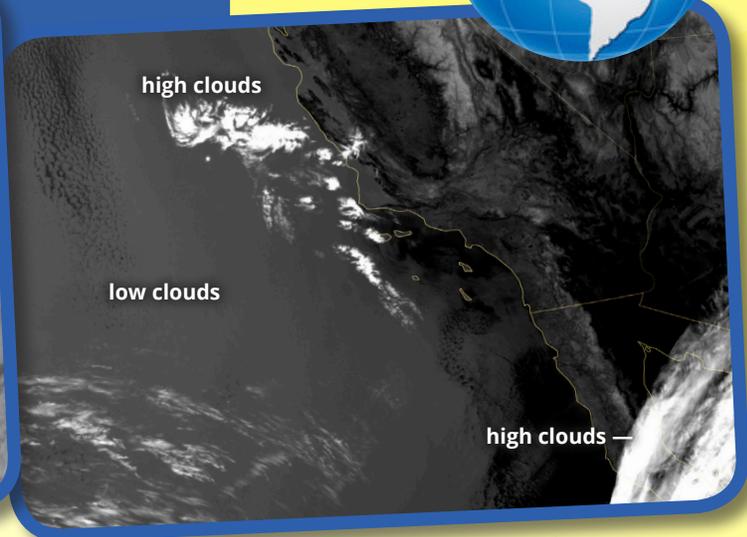
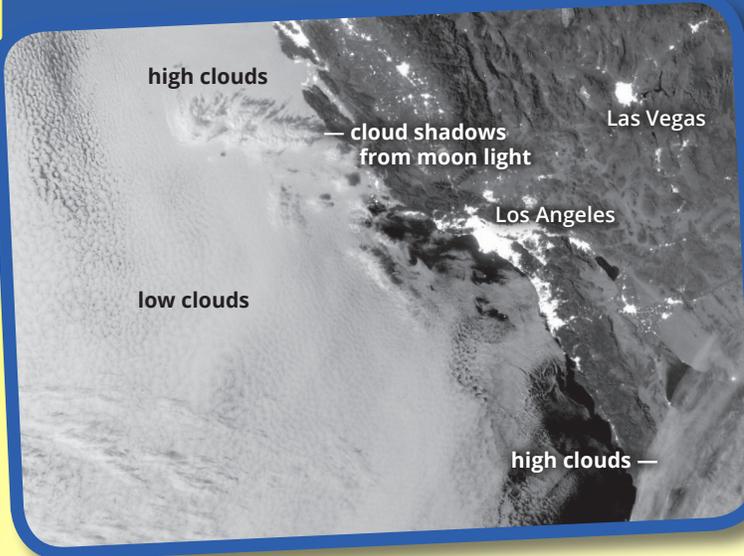
Clouds can vary in temperature, too. For instance, low clouds are typically warmer than high clouds. High cirrus clouds are made up of tiny ice crystals, but low stratus clouds are made up of water vapor.



Rainbows show us every type of light that we can see. But just beyond the ends of the rainbow are types of light that we can't see. Just beyond red is infrared light, and some satellite sensors are built to see this. (Ultraviolet is just past the violet end of the rainbow.)

Hide and Seek

In natural light (left), it can be hard to distinguish low and high clouds. In the infrared satellite image (right), the cold, high clouds become more visible, but the low stratus clouds blend in with the land because they are roughly the same temperature.



California, United States



How do clouds form?

Clouds form when moist air cools and condenses. Our atmosphere is full of water vapor molecules, but they can't form clouds until they cool enough to condense. Our atmosphere is always pushing against us. Without it, our bodies would explode. This atmospheric pressure exists because gravity is

pulling the molecules in the sky toward Earth. Near the surface, where gravity is greatest, the pressure from the atmosphere is also greatest. As you rise toward space, where there are less molecules above and less gravity, pressure decreases. As pressure decreases, temperatures drop and the moist air condenses, forming clouds.

MakerCorner

Make Your Own Cloud (In a Bottle)

By experimenting with temperature and pressure, you can make your own cloud appear in a bottle in this simple demonstration.

Materials:

- ball pump
- inflating needle
- cork
- scissors
- microwave oven
- soda bottle
- rubbing alcohol
- adult supervision



What is happening?

When you pump air into the bottle, you increase the pressure inside. But when you let the cork go, some air rushes out and the pressure quickly decreases. This causes the temperature to drop and the molecules in the bottle to quickly **condense**.

In our atmosphere, clouds form from molecules of water vapor, but in this experiment we use

rubbing alcohol because it evaporates more quickly. The evaporated alcohol molecules condense as the pressure and temperature drop, forming a cloud (just like water vapor in our atmosphere).

Try It!

- 1 Cut the cork in half with the scissors. Use only one half of the cork for steps 2 – 9.



- 2 Microwave the cork for 15 seconds.
- 3 Push the inflating needle through the center of the bottom of the cork.

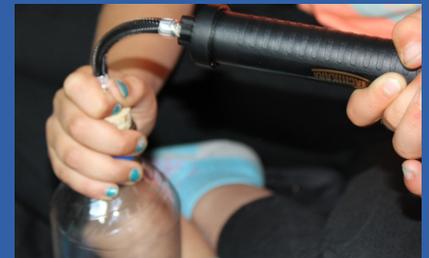


- 4 Attach the inflating needle to the ball pump.

- 5 Pour approximately 1-2 tablespoons of rubbing alcohol into the soda bottle.



- 6 Put the cork in the soda bottle to seal it.
- 7 Securely hold the cork in the bottle while someone pumps the ball pump.



- 8 Pump until you can't squeeze the bottle, then let go of the cork.
- 9 Watch the cloud form in the bottle.



Vocabulary:

condense — To make something denser by squeezing molecules closer together.

Be a NASA Scientist with GLOBE Observer: Clouds



Citizen science projects give kids like you a chance to make a difference in the science community. Since clouds can change rapidly, scientists need frequent observations from citizen scientists. Making cloud observations with the GLOBE Observer app can help NASA scientists understand clouds from below (the ground) and above (from space). All you have to do is use the app to take pictures of clouds and answer some questions about what you see. If you time your observations with a satellite overpass, you can help scientists understand more about the clouds that they study with satellites.

To get started, ask a parent or guardian to download the app with you.

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